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Attorney Docket No. P06276-US  
(CLO.012)

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### REMARKS

Entry of this Amendment is proper because it does not raise any new issues requiring further search by the Examiner, narrows the issues on appeal, and is believed to place the present application in condition for immediate allowance.

Claims 1-18 are all the claims presently pending in the application.

No claims have been amended and no new matter is added.

Claims 17 and 18 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite.

Claims 1-11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Takeishi (U.S. Patent No. 6,778,038) in view of Onishi (U.S. Patent No. 5,459,368).

This rejection is respectfully traversed in the following discussion.

### **I THE CLAIMED INVENTION**

In a conventional duplexer using a conventional piezo-electric resonator, small size cannot be sufficiently obtained. In conventional devices, no consideration has been given to the reliability in mounting, such as precision of positioning in the face-down bonding and the like, or the reliability in operation, such as changes of frequency characteristics and the like.

The claimed invention, on the other hand, provides an electronic component including a piezo-electric resonator utilizing a bulk wave propagating through a piezo-electric film. The piezo-electric resonator is capable of advantageously being made small in size, and thus, can be used in a duplexer for separating a transmission signal and a reception signal, for example, in a portable wireless communication apparatus.

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For example, the Applicants have recognized that, when the distance L1 (e.g., see Figures 2 and 3; *all reference numerals herein being used for the Examiner's clarity only and not for limiting the claims*) between a surface of the piezo-electric resonator 10 facing the packaging substrate 19 and a surface of the packaging substrate 19 facing the piezo-electric resonator 10 is not larger than 100  $\mu\text{m}$ , the junction positions of the bumps 18 in the packaging substrate 19 have swerved from the predetermined positions only by  $\pm 7 \mu\text{m}$ .

Applicants have recognized that, in view of the relation between the distance L1 and a swerve of the position of the bumps, the distance L1 is determined to be preferably not larger than 100  $\mu\text{m}$ , as exemplarily defined by independent claim 1. Accordingly, precision of positioning becomes better in the face-down bonding and the reliability of mounting can be improved in the face-down bonding (e.g., see specification at page 8, lines 4-18).

On the other hand, Applicants also have recognized that, when a maximum diameter L2 of the bumps 18 after the bumps 18 formed on the piezo-electric resonator 10 have been junctioned on the packaging substrate 19 preferably is not larger than 150  $\mu\text{m}$  (as exemplarily defined by independent claim 2), a pad having an area of  $165 \times 165 \mu\text{m}^2$  is located on the piezo-electric resonator 10 with respect to one bump 18. Subsequently, in order to form the eight bumps 18, eight pads each having the area of  $165 \times 165 \mu\text{m}^2$  are located on the piezo-electric resonator 10. As a result, the piezo-electric resonator 10 has a size of  $1 \times 1.7 \text{ mm}^2$  including a portion of a filter. Consequently, a crack was generated in a portion of the element substrate 11 on which the one bump 18 is located in only approximately three percentages of the piezo-electric resonators 10.

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Thus, with respect to the maximum diameter L2 and a size of the piezo-electric resonator 10, from the view point of area efficiency and a possibility of generation of the cracks, Applicants have recognized that the maximum diameter L2 preferably should not be larger than 150  $\mu\text{m}$ , as exemplarily defined by independent claim 2 (e.g., see specification at page 9, lines 25-29).

Moreover, Applicants also have recognized that, when the distance L3 between a surface of the piezo-electric resonator 10 facing the lid 21 and a surface of the lid 21 facing the piezo-electric resonator 10 is not larger than 150  $\mu\text{m}$ , the center frequency of the piezo-electric resonator 10 was only varied by approximately 0.1 percentage among approximately five percentages of the piezo-electric resonators 10. Accordingly, Applicants have recognized that the distance L3 preferably is not larger than 150  $\mu\text{m}$ , as exemplarily defined by independent claim 4 (e.g., see specification at page 10, lines 18-29).

## II. CLAIM REJECTION UNDER 35 U.S.C. § 112

Claims 17 and 18 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite.

The Examiner alleges that, in claim 1, the distance between the piezoelectric substrate and the ceiling member is limited to 100  $\mu\text{m}$  or less, and thus, claims 17 and 18 contradict claim 1 by allowing a distance of 150  $\mu\text{m}$ .

Applicant respectfully notes, however, that claim 1 defines the distance between a surface of the piezo-electric resonator facing the packaging substrate and a surface of the packaging substrate facing the piezo-electric resonator as not being larger than 100  $\mu\text{m}$ .

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For example, this distance is exemplarily shown by L1 in Figure 2 of the present application.

However, claims 17 and 18 do not further define this distance (e.g., L1 in Figure 2; *all reference numerals herein being used for the Examiner's clarity only and not for limiting the claims*).

Instead, claim 17 defines a distance between a surface of the piezo-electric resonator facing the sealing member and a surface of the sealing member facing the piezo-electric resonator as being equal to or less than 150  $\mu\text{m}$ . For example, this distance is exemplarily shown by L3 in Figure 2 of the present application.

Similarly, claim 18 defines a distance between a surface of the piezo-electric resonator facing the sealing member and a surface of the sealing member facing the piezo-electric resonator as being equal to or less than 150  $\mu\text{m}$ . Again, this distance is exemplarily shown by L3 in Figure 2 of the present application.

Thus, claims 17 and 18 do not contradict the features of claim 1.

For the foregoing reasons, claims 17 and 18 are not indefinite. The Examiner is requested to reconsider and withdraw this rejection.

### III. THE PRIOR ART REJECTION

Claims 1-11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Takeishi in view of Onishi. For the following reasons, Applicants traverse this rejection.

As a preliminary matter, Applicants incorporate herein by reference all of the traversal arguments set forth in the Amendment under 37 C.F.R. § 1.111 filed on October 18, 2005, for the Examiner's convenience.

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**Independent claim 2**  
**and Dependent claims 3, 14, and 16**

Applicants submit that neither the previous Office Action nor the present Office Action have addressed the specific features recited by claims 2, 3, 14, and 16.

That is, the Examiner has not addressed (or mentioned) the specific features defined by independent claim 2 in the present Office Action. Instead, the Examiner appears to have mischaracterized the meaning of the “*diameter*” of the electrically connected projecting portion.

For example, contrary to the Examiner's position in the Office Action, claim 2 does not define the “*diameter*” as being the thickness of the connecting portion (e.g., bump 18 in Figure 2) between the package substrate 19 and the piezo-electric resonator 10. Instead, the “*diameter of said electrically connected projecting portion*” represents the width or length of the bump 18, in a direction extending along the surface of the package substrate 19 and the piezo-electric resonator 10, as illustrated by L2 in Figure 2.

Specifically, claim 2 recites, *inter alia*, that “a maximum diameter of said electrically connected projecting portion being not larger than 150  $\mu$ m when said electrically connected projecting portion is connected to said packaging substrate” (emphasis added).

Dependent claims 3 and 14 depend from claim 2. Claim 16 depends from claim 1, but also recites somewhat similar features as independent claim 2.

Thus, the present Office Action has mischaracterized the meaning of the claimed “*diameter*” and fails to establish a *prima facie* case of obviousness with respect to independent claim 2 and dependent claims 3, 14, and 16.

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**Independent claim 4**  
**and Dependent claims 5-8, 15, 17, and 18**

With respect to claims 4-8, 15, 17, and 18, Applicants submit that neither the previous Office Action nor the present Office Action have addressed the specific features recited by claims 4-8, 15, 17, and 18.

For example, independent claim 4 recites, *inter alia*, that "a distance between a surface of said piezo-electric resonator facing said sealing member and a surface of said sealing member facing said piezo-electric resonator being not larger than 150  $\mu$ m" (emphasis added).

The "distance", which is exemplarily defined by claim 4, is exemplarily shown by L3 in Figure 2 of the present application (*all reference numerals herein being used for the Examiner's clarity only and not for limiting the claims*).

However, none of the Office Actions, to date, have addressed (or mentioned) this dimension or distance (e.g., L3 in Figure 2) between the surface of the piezo-electric resonator (e.g., 10 in Figure 2) and the sealing member (e.g., lid 21 in Figure 2), as defined by independent claim 4 and dependent claims 5-8, 15, 17, and 18.

An important feature which Applicants have recognized is that, when the distance L3 (e.g., see Figure 2) between a surface of the piezo-electric resonator 10 facing the lid 21 and a surface of the lid 21 facing the piezo-electric resonator 10 is not larger than 150  $\mu$ m, the center frequency of the piezo-electric resonator 10 was only varied by approximately 0.1 percentage among approximately five percentages of the piezo-electric resonators 10.

That is, Applicants have recognized that the distance L3 between the piezo-electric resonator 10 and the lid 21 preferably is not larger than 150  $\mu$ m, as exemplarily defined

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by independent claim 4 and dependent claims 5-8, 15, 17, and 18 (e.g., see specification at page 10, lines 18-29).

Thus, the present Office Action clearly fails to establish a *prima facie* case of obviousness with respect to independent claim 4 and dependent claims 5-8, 15, 17, and 18.

Applicant notes that dependent claims 5-8 and 15 depend from claim 4. on the other hand, dependent claims 17 and 18 depend from claim 1, but also recite somewhat similar features as independent claim 4.

Moreover, the Examiner specifically acknowledges that Takeishi does not explicitly provide a cover, which the Examiner appears to compare to the claimed "sealing member", as recited in claimed invention.

However, the Examiner alleges that Onishi makes up for the acknowledged deficiencies of Takeishi by providing a housing to protect and shield a flip-chip mounted piezo-electric resonator. Thus, the Examiner asserts that it would have been obvious to provide a cover for Takeishi.

Applicants respectfully submit, however, that the Examiner has not identified any teaching in Onishi, which the Examiner relies on for the claimed "sealing member", for the claimed "distance between a surface of said piezo-electric resonator facing said sealing member and a surface of said sealing member facing said piezo-electric resonator being not larger than 150  $\mu$ m", as recited in independent claim 4 (emphasis added).

That is, even assuming *arguendo* that it would have been obvious to combine Takeishi and Onishi, as alleged by the Examiner, neither Takeishi nor Onishi discloses or suggests "a distance between a surface of said piezo-electric resonator facing said

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*sealing member and a surface of said sealing member facing said piezo-electric resonator being not larger than 150  $\mu\text{m}$* ", as recited in independent claim 4 (emphasis added).

For the foregoing reasons, independent claim 4 and dependent claims 5-8, 15, 17, and 18 clearly are not rendered obvious from Takeishi and Onishi, either individually or in combination.

Should the Examiner maintain this rejection, Applicants request that the Examiner properly establish the motivation for combining Takeishi and Onishi to arrive at the claimed combination, as recited by independent claim 4 and dependent claims 5-8, 15, 17, and 18, that a reasonable expectation of success would have been expected, and that the alleged combination teaches or suggests each and every limitation of independent claim 4 and dependent claims 5-8, 15, 17, and 18.

Moreover, none of the Office Actions to date have identified any teaching in Takeishi or Onishi in which the "*surface of said piezo-electric resonator facing said sealing member and said surface of said sealing member facing said piezo-electric resonator are coupled with each other*", as recited in claim 5 (emphasis added).

Also, none of the Office Actions to date have identified any teaching in Takeishi or Onishi in which "*a buffer is located for burying a space between said piezo-electric resonator and said sealing member*", as recited by claim 7 (emphasis added).

Further, none of the Office Actions to date have identified any teaching in Takeishi or Onishi in which "*said buffer comprises an adhesive for fixing said piezo-electric resonator and said sealing member*", as recited by claim 8 (emphasis added). The present application clearly describes that the reliability of mounting the piezo-electric resonator can be improved, according to the claimed invention (e.g., see specification at page 11, lines 8-11).



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For the foregoing reasons, neither the previous Office Action nor the present Office Action have addressed the specific features of, for example, the distance between the piezo-electric resonator and the sealing member, as recited by claims 4-8, 15, 17, and 18.

Thus, the rejection of claims 4-8, 15, 17, and 18 clearly are improper and fail to establish a *prima facie* case of obviousness.

Applicants respectfully traverse this rejection. Applicants requests that the Examiner reconsider and withdraw this rejection and permit claims 4-8, 15, 17, and 18 to pass to immediate allowance.

**Independent Claim 1  
 and Dependent claims 9-13**

With respect to independent claim 1, the Examiner alleges that Takeishi explicitly notes (see column 3, lines 4-13) that the prior art typically uses solder bumps having a diameter of several tens to 100  $\mu\text{m}$ . The Examiner asserts that this establishes the prior art air gap as being equal to the bump dimension plus the piezoelectric electrode dimension plus the substrate electrode dimension. Since the thickness (diameter) of the solder or bump can vary between 30  $\mu\text{m}$  (several tens) to 100  $\mu\text{m}$  prior to the assembly which would reduce the height dimension, it is felt that this is a clear teaching of providing an air gap of less than 100  $\mu\text{m}$ .

Applicants respectfully traverse this rejection for the following reasons.

While Applicants appreciate the Examiner's attempt to calculate the air gap (i.e., the distance between the base body 11 and the mounting substrate 30) in the device of Takeishi, Applicants respectfully submit that, absent a specific disclosure in Takeishi of the resulting air gap distance, such cannot be determined with any (e.g., reasonable)

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certainty, based merely on assumptions of the resulting air gap after the heating or ultrasonic bump bonding.

Indeed, Takeishi specifically discloses that the bumps 21 are bonded to the conductors 32, 33, and 35 in a solid phase without melting the bumps 21, regardless of whether an ultrasonic wave or heating is used in the bonding process (e.g., see Takeishi at column 12, lines 46-57).

Thus, absent a specific disclosure in Takeishi of the resulting air gap distance, the actual air gap distance of the device of Takeishi cannot be determined with reasonable certainty based merely on assumptions of the resulting air gap after the heating or ultrasonic bump bonding.

For the foregoing reasons, Applicants respectfully reiterate that independent claim 1 and dependent claims 9-13 clearly are not rendered obvious from Takeishi and Onishi, either individually or in combination.

#### **Dependent Claims 12-14 and 16**

First, claims 12-14 and 16 are patentable over the cited references, either individually or in combination, at least by virtue of their dependency from independent claims 1 and 2, respectively.

Second, with respect to claims 12-14 and 16, the Examiner alleges that the features of these claims merely optimize a known device through routine experimentation (see Office Action at page 3, lines 11-18).

However, Applicant notes that it is settled law that a particular parameter must first be recognized by the prior art as a result-effective variable, before the determination of the optimum or workable ranges of the variable might be characterized as routine

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experimentation (e.g., see *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977); see also M.P.E.P. § 2144.05(II)(B)).

Since neither Takeishi nor Onishi recognizes the claimed parameters as a result-effective variable, the alleged determination of the optimum or workable ranges of the variable is not properly characterized as routine experimentation.

Indeed, as the Examiner points out, Takeishi does not even mention the air gap thickness, or its criticality. Hence, presumably, this is the reason the Examiner himself had to provide a calculation of what the air gap thickness allegedly would be, based on the other elements of the device which is illustrated by Takeishi (see Office Action at page 3).

In comparison, the present application clearly describes that, when the distance L1 (e.g., see Figures 2 and 3) between a surface of the piezo-electric resonator 10 facing the packaging substrate 19 and a surface of the packaging substrate 19 facing the piezo-electric resonator 10 is not larger than 100  $\mu\text{m}$  (and preferably not larger than 50  $\mu\text{m}$ , and more preferably not larger than 25  $\mu\text{m}$ ), precision of positioning becomes better in the face-down bonding and the reliability of mounting can be improved in the face-down bonding (e.g., see specification at page 8, lines 4-18). The present application discloses the criticality of these features in that the amount of swerving of the junction positions of the bumps 18 from predetermined positions can be reduced, and thus, the size of the electrode to be junctioned in the packaging substrate also can be reduced (e.g., see specification at page 7, lines 17-29, and page 8, lines 1-4).

Turning to the claims, claim 12 recites, *inter alia*, that "*said distance between the surface of said piezo-electric resonator facing said packaging substrate and the surface*

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*of said packaging substrate facing said piezo-electric resonator is equal to or less than 50  $\mu\text{m}$* " (emphasis added),

Claim 13 recites, *inter alia*, that "said distance between the surface of said piezo-electric resonator facing said packaging substrate and the surface of said packaging substrate facing said piezo-electric resonator is equal to or less than 25  $\mu\text{m}$ " (emphasis added).

As mentioned above, since neither Takeishi nor Onishi recognizes the claimed parameters as a result-effective variable, the alleged determination of the optimum or workable ranges of the variable is not properly characterized as routine experimentation.

Thus, Applicants submit that at least claims 12 and 13 clearly are not rendered obvious from the alleged combination of Takeishi and Onishi.

For the foregoing reasons, Takeishi and Onishi, either individually or in combination do not disclose or suggest all of the features of the claimed invention.

Therefore, the Examiner is requested to reconsider and withdraw this rejection and to permit these claims to pass to immediate allowance.

#### IV. FORMAL MATTERS

Applicants respectfully reiterate the request that the Examiner acknowledge Applicants' claim to foreign priority under 35 U.S.C. § 119 and indicate that all of the certified copies of the priority document have been received by checking the appropriate boxes 12(a)(1) of the Office Action Summary.

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## V. CONCLUSION


In view of the foregoing, Applicants submit that claims 1-18, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: February 13, 2006


  
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### CERTIFICATE OF TRANSMISSION

I certify that I transmitted via facsimile to (571) 273-8300 the enclosed Amendment under 37 C.F.R. § 1.116 to Examiner Mark Budd, Art Unit 2834, on February 13, 2006.

  
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